MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

PEM0026 – TRIGONOMETRY AND GEOMETRY

(All sections / Groups)

15 OCTOBER 2015
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 5 pages including cover page and appendix with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided. All necessary working steps **MUST** be shown.

4. Only **NON-PROGRAMMABLE** calculator is allowed.

APPENDIX

$\sin^2\theta+\cos^2\theta=1$; $\sec^2\theta=1+\tan^2\theta$; $\csc^2\theta=1+\cot^2\theta$

$\sin 2\theta=2\sin\theta\cos\theta$

$\cos 2\theta=\cos^2\theta-\sin^2\theta=2\cos^2\theta-1=1-2\sin^2\theta$

$\tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$

$\sin(x\pm y)=\sin x\cos y\pm\cos x\sin y$

$\cos(x\pm y)=\cos x\cos y\mp\sin x\sin y$

$\tan(x\pm y)=\dfrac{\tan x\pm\tan y}{1\mp\tan x\tan y}$

$2\sin x\cos y=\sin(x+y)+\sin(x-y)$
$2\cos x\cos y=\cos(x+y)+\cos(x-y)$
$2\sin x\sin y=\cos(x-y)-\cos(x+y)$

$\sin x+\sin y=2\sin\dfrac{x+y}{2}\cdot\cos\dfrac{x-y}{2}$; $\sin x-\sin y=2\cos\dfrac{x+y}{2}\cdot\sin\dfrac{x-y}{2}$

$\cos x+\cos y=2\cos\dfrac{x+y}{2}\cdot\cos\dfrac{x-y}{2}$; $\cos x-\cos y=-2\sin\dfrac{x+y}{2}\cdot\sin\dfrac{x-y}{2}$

$\sin^2\dfrac{x}{2}=\dfrac{1-\cos x}{2}$; $\cos^2\dfrac{x}{2}=\dfrac{1+\cos x}{2}$; $\tan^2\dfrac{x}{2}=\dfrac{1-\cos x}{1+\cos x}$

$\sin\dfrac{x}{2}=\pm\sqrt{\dfrac{1-\cos x}{2}}$;

$\cos\dfrac{x}{2}=\pm\sqrt{\dfrac{1+\cos x}{2}}$

$\tan\dfrac{x}{2}=\pm\sqrt{\dfrac{1-\cos x}{1+\cos x}}=\dfrac{1-\cos x}{\sin x}=\dfrac{\sin x}{1+\cos x}$

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QUESTION 1

a. Given that the function $y = -2\sin\left(-3x + \frac{\pi}{2}\right)$.

i. Find the amplitude, period and phase shift of the function. [3 marks]

ii. Graph the function over the interval of $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$. [5 marks]

b. Given that $\sec\theta = \frac{7}{4}$ and $\sin\theta < 0$. Find the remaining five trigonometric functions of θ. [7 marks]

c. A hot air balloon is between two spotters who are 1.3 meters apart. One spotter reports that the angle of elevation is 65° and the other reports that it is 75°, as shown in Figure Q1. The distance of the spotters from the base of the hot air balloon is represented by X and Y respectively. What is the altitude, h of the balloon?

[10 marks]

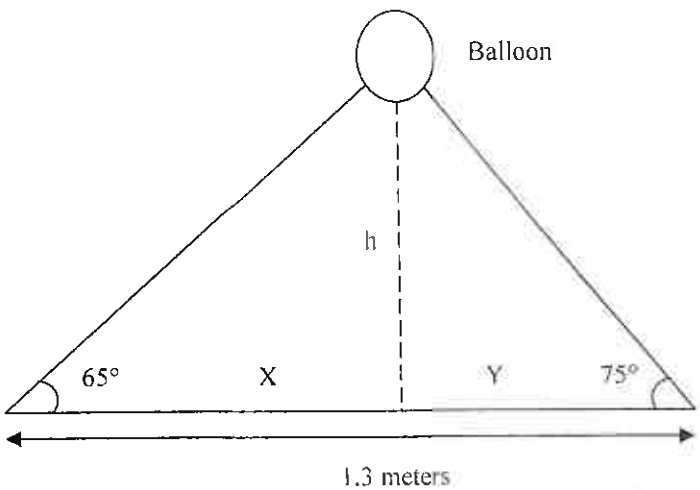

Figure Q1

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QUESTION 2

a. Prove the identity $\dfrac{1-\cot^2\theta+\cos^2\theta\cot^2\theta}{\csc^2\theta}=\sin^2\theta$. [6 marks]

b. Find the exact value of $\cos(A+B)$ if $\sin A=-\dfrac{3}{5}$ and $\sin B=-\dfrac{12}{13}$, with A in quadrant III and B in quadrant IV.

[6 marks]

c. Write the expression for $\cot(\cos^{-1}U)$ as an algebraic (nontrigonometric) expression in terms of U, where $U>0$.

[4 marks]

d. Find all real numbers, in terms of π, in the interval $[0,2\pi)$ that satisfy the equation $2\sin(2\theta)\sin\theta=\cos\theta$. [9 marks]

QUESTION 3

a. Given $z_1=6\left(\cos\dfrac{\pi}{3}+i\sin\dfrac{\pi}{3}\right)$ and $z_2=3\left(\cos\dfrac{\pi}{6}+i\sin\dfrac{\pi}{6}\right)$, find in $a+ib$ form for

i. z_1 and z_2. [2 + 2 marks]

ii. $\dfrac{z_1}{z_2}$ [6 marks]

b. If $\mathbf{a}=\mathbf{i}+\mathbf{j}+3\mathbf{k}$ and $\mathbf{b}=2\mathbf{i}+\mathbf{k}$, find

i. the value of sine of the angle between **a** and **b**. [6 marks]

ii. a unit vector which is perpendicular to **a** and **b**. [2 marks]

c. Given $a=3i+4j$ and $b=-3i+j$. Point $P(2,-2)$ and $Q(8,3)$ are connected in straight line. If $\vec{PQ}=ha+kb$, h and k are constant. Find the value h and k.

[7 marks]

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QUESTION 4

a. Figure Q4 shows the straight line PR which intersects the y-axis at point Q. The line equation of PR is $3y = 2x - 15$.

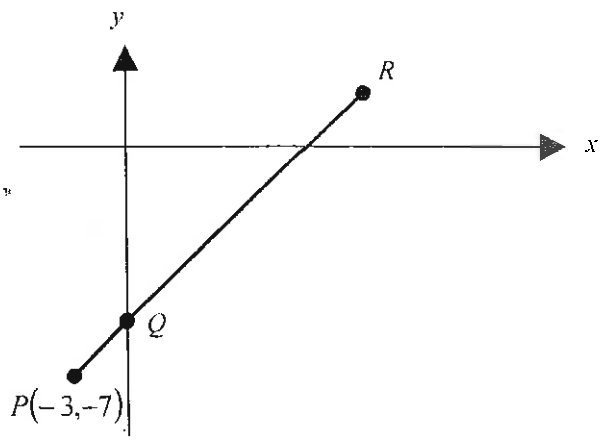

Figure Q4

i. Find the equation of straight line which passes through point P and perpendicular to line PR. [3 marks]

ii. Find the coordinate of Q. [1 mark]

iii. Given $PQ : QR = 2 : 7$, find coordinate of R. [3 marks]

b. Given an equation $16x^2 + 4y^2 - 64x - 40y + 100 = 0$

i. Show that the equation represents an ellipse. [4 marks]

ii. Find the center, foci and vertices of the ellipse [4 marks]

iii. Sketch the ellipse. [4 marks]

c. Find the range of values of p such that the straight line $y = px + 1$ does not intersect the parabola $y^2 = 8x$. [6 marks]

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